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# Improved Outcomes in CKD with a Plant Forward Approach

TODAY'S AGENDA:

- Introduction & Housekeeping
- Speaker Introduction
- Presentation
- Q&A
- Closing

## WEBINAR HOST:

**Keith Hine MS, RD**
VP of Healthcare, Sports & Professional Education
Orgain, LLC

## WEBINAR PRESENTER:

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Registered Dietitian
University of Chicago
The Kidney Dietitian Blog (thekidneydietitian.org)

# Improved Outcomes in CKD with a Plant Forward Approach

Melanie Betz MS, RD, CSR, CSG, LDN

Chronic Kidney Disease Nutrition & Education Specialist

University of Chicago

The Kidney Dietitian Blog

www.thekidneydietitian.org

# Outline

Benefits of plant based diets in kidney disease

- Delayed progression CKD
- Acidosis
- Gut health
- Phosphorus
- Potassium
- Dialysis & mortality

# Chronic Kidney Disease Stats

Affects 37 million people (1 in 7 adults) in US

80 million people (1 in 3 adults) in US *at risk* of kidney disease

90% of people with kidney disease *don't know they have it*

9th leading cause of death in U.S

$120 billion annual Medicare dollars for all stages CKD (~15% total budget)
$84 billion on ESRD

Kidney Disease: The Basics. National Kidney Foundation. Published August 12, 2014. Accessed September 15, 2020. https://www.kidney.org/news/newsroom/factsheets/KidneyDiseaseBasics

## What I Was Taught in School

## What I Recommend Now

Traditional “Renal Diet” Approach:

- Tends to be non-individualized & generic
- Reduces food to nutrients
  - Sodium
  - Potassium
  - Phosphorus
- Resulted in diet drastically reduced in generally healthy things!
  - Fiber
  - Most vitamins & minerals
  - Antioxidants
- Maybe not the best for our patients?

# Plant-Based Diet Definition

No formal definition

Just eat more plants!

- Average US Intake: 0.9 servings fruits & 1.4 servings vegetables

Examples:

- Vegan or Vegetarian Diet
- Mediterranean Diet
- DASH Diet
- MIND Diet

USDA ERS - Americans Still Can Meet Fruit and Vegetable Dietary Guidelines for $2.10-$2.60 per Day. Accessed August 19, 2020. https://www.ers.usda.gov/amber-waves/2019/june/americans-still-can-meet-fruit-and-vegetable-dietary-guidelines-for-210-260-per-day/

# Benefits of Plant-Based Diets & CKD

- Delayed decline of kidney function
- Improved acid-base balance
- Improved gut health
- Reduced bioavailability of phosphorus
- Better potassium control?
- Reduced mortality in dialysis?

In line with recommendations for common co-morbid conditions

*Diabetes*
*Hypertension*
*Hypercholesterolemia*
*Heart Failure*
***= Improved control CKD!***

Potentially improved adherence, quality of life and food satisfaction!

# Delayed Decline of Kidney Function

# Lower Risk of ESRD with DASH in CKD Patients

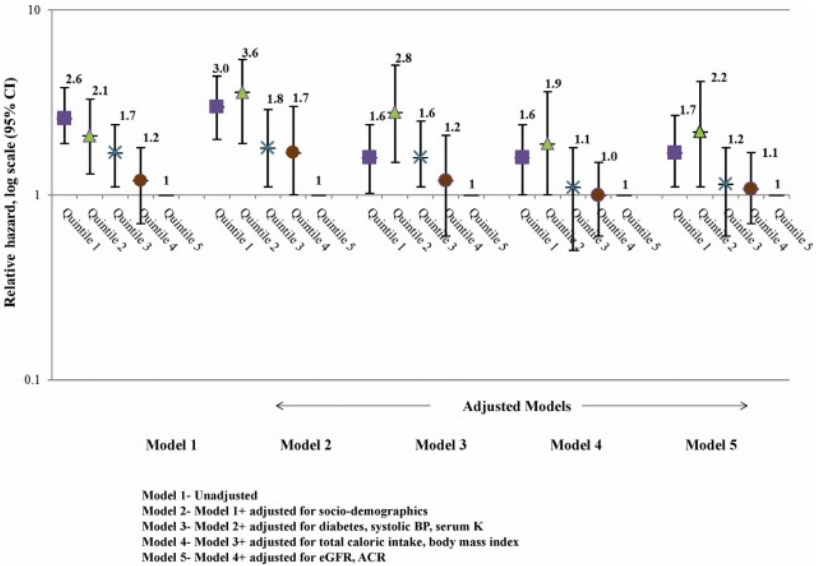



**Figure 1 | Longitudinal association of baseline Dietary Approaches to Stop Hypertension diet accordance score quintile with progression to end-stage renal disease among U.S. adults aged 20 and over with moderate chronic kidney disease and hypertension, unadjusted and adjusted for covariates.** Median follow-up, 7.8 years (25th–75th percentiles, 4.7–12.4). (CI, confidence interval.)

Banerjee T, Crews DC, Tuot DS, et al. Poor accordance to a DASH dietary pattern is associated with higher risk of ESRD among adults with moderate chronic kidney disease and hypertension. *Kidney International*. 2019;95(6):1433-1442. doi:10.1016/j.kint.2018.12.027

# Less GFR Decline with "Prudent" and DASH Eating Patterns

**Table 5.** Odds Ratios for eGFR Decline ≥30% by Quartiles of Diet Pattern Scores

| | Q1 | Q2 | Q3 | Q4 |
|---|---|---|---|---|
| Western | | | | |
| Age and energy intake adjusted | 1.00 (reference) | 1.37 (0.98-1.93) | 1.84 (1.29-2.64) | 1.95 (1.27-2.97) |
| Multivariable[a] | 1.00 (reference) | 1.22 (0.87-1.73) | 1.57 (1.08-2.28) | 1.48 (0.95-2.30) |
| Multivariable + analgesic medication use[b] | 1.00 (reference) | 1.22 (0.86-1.72) | 1.52 (1.04-2.20) | 1.40 (0.90-2.19) |
| Multivariable + high cholesterol or lipid-lowering drug | 1.00 (reference) | 1.23 (0.87-1.73) | 1.57 (1.08-2.26) | 1.46 (0.94-2.28) |
| Multivariable + diabetes duration | 1.00 (reference) | 1.22 (0.86-1.72) | 1.58 (1.09-2.29) | 1.46 (0.94-2.28) |
| Prudent | | | | |
| Age and energy intake adjusted | 1.00 (reference) | 1.44 (1.05-1.97) | 1.06 (0.76-1.48) | 0.78 (0.53-1.13) |
| Multivariable[a] | 1.00 (reference) | 1.43 (1.04-1.98) | 1.07 (0.76-1.51) | 0.81 (0.55-1.19) |
| Multivariable + analgesic medication use[b] | 1.00 (reference) | 1.44 (1.04-1.98) | 1.10 (0.78-1.56) | 0.82 (0.56-1.21) |
| Multivariable + high cholesterol or lipid-lowering drug | 1.00 (reference) | 1.45 (1.05-2.00) | 1.09 (0.77-1.54) | 0.84 (0.57-1.23) |
| Multivariable + diabetes duration | 1.00 (reference) | 1.44 (1.04-1.98) | 1.07 (0.76-1.51) | 0.81 (0.55-1.19) |
| DASH-style | | | | |
| Age and energy intake adjusted | 1.00 (reference) | 0.87 (0.64-1.18) | 0.79 (0.58-1.09) | 0.51 (0.36-0.72) |
| Multivariable[a] | 1.00 (reference) | 0.86 (0.63-1.17) | 0.79 (0.57-1.09) | 0.55 (0.38-0.80) |
| Multivariable + analgesic medication use[b] | 1.00 (reference) | 0.88 (0.65-1.21) | 0.82 (0.60-1.13) | 0.57 (0.39-0.83) |
| Multivariable + high cholesterol or lipid lowering drug | 1.00 (reference) | 0.86 (0.63-1.18) | 0.79 (0.58-1.09) | 0.55 (0.38-0.79) |
| Multivariable + diabetes duration | 1.00 (reference) | 0.87 (0.64-1.18) | 0.79 (0.58-1.09) | 0.55 (0.38-0.80) |

Abbreviations: eGFR, estimated glomerular filtration rate; DASH, Dietary Approach to Hypertension; NSAIDs, nonsteroidal anti-inflammatory drugs; Q, quartile.

[a]Adjusted for age, hypertension, body mass index, physical activity (METs/week), energy intake, cigarette smoking, diabetes, cardiovascular disease, and angiotensin-converting enzyme–inhibitor/angiotensin receptor blocker medication use (alcohol intake and

Lin J, Fung TT, Hu FB, Curhan GC. Association of dietary patterns with albuminuria and kidney function decline in older white women: a subgroup analysis from the Nurses' Health Study. *Am J Kidney Dis*. 2011;57(2):245-254. doi:10.1053/j.ajkd.2010.09.027

# Reduced Risk Death in CKD

Reduced all cause mortality in CKD

- Plant based diet scores associated with reduced risk mortality (0.77: 95% CI: 0.61-0.97)
- Southern diet scores associated with increased risk mortality (1.51: 95% CI: 1.19-1.95
- No significant difference in CKD progression

Gutiérrez OM, Muntner P, Rizk DV, et al. Dietary patterns and risk of death and progression to ESRD in individuals with CKD: a cohort study. *Am J Kidney Dis*. 2014;64(2):204-213.

# Improved Acid/Base Balance

# Metabolic Acidosis in CKD

Definition: Serum Bicarbonate ($CO_2$) <22mEq/L

Prevalence

- 13% CKD stage 3
- 40% by CKD stage 4
- Acid retention early in CKD

Causes in CKD

- Impaired ammonia excretion
- Reduced bicarbonate reabsorption
- Reduced bicarbonate production

- Consequences:
  - Increased bone resorption
  - Increased muscle catabolism
  - Aggravation secondary hyperparathyroidism
  - Systemic inflammation
  - Impaired myocardial contractility
  - *Increased mortality*
  - *Progression of CKD*

Kraut JA, Madias NE. Metabolic Acidosis of CKD: An Update. *American Journal of Kidney Diseases*. 2016;67(2):307-317. doi:10.1053/j.ajkd.2015.08.028

# Dietary Acid Production

Diet is the main contributor to acid that must be excreted by the kidney

Balance of:

- Endogenous acid production ($H^+$)
  - *Primarily from protein (especially sulfur containing amino acids methionine & cysteine) that are metabolized to cation*
- Alkali intestinal absorption
  - *Primarily from fruits & veggies*
  - *Metabolized to produce bicarbonate or anion*

Measuring Acid Load

- Net Acid Excretion (NAE, requires 24-hour urine test)
- Potential Renal Acid Load (PRAL)
- Net Endogenous Acid Production (NEAP)
- GI alkali absorption

Scialla JJ, Anderson CAM. Dietary acid load: a novel nutritional target in chronic kidney disease? *Adv Chronic Kidney Dis*. 2013;20(2):141-149. doi:10.1053/j.ackd.2012.11.001
Ströhle A, Waldmann A, Koschizke J, Leitzmann C, Hahn A. Diet-dependent net endogenous acid load of vegan diets in relation to food groups and bone health-related nutrients: results from the German Vegan Study. *Ann Nutr Metab*. 2011;59(2-4):117-126. doi:10.1159/000331572

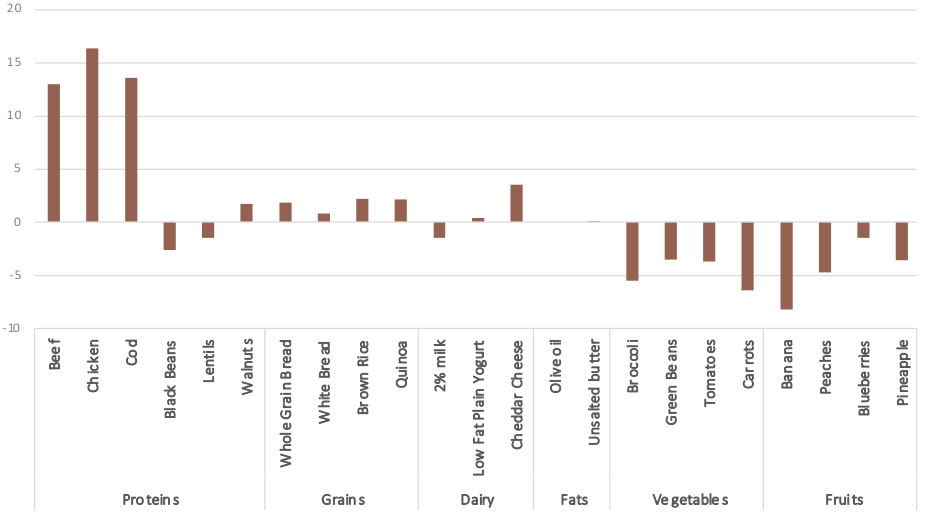
# Potential Renal Acid Load (PRAL)

High acid load in typical US Diet

50-75 mEq/day

Vegan (or near vegan) diet: -43.5 - -39.0 mEq/day

# Potential Renal Acid Load (per standard portion)




High acid load in typical US Diet

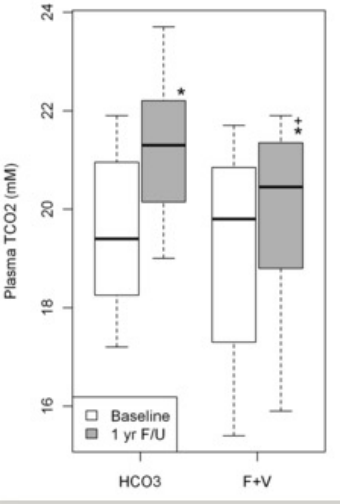
50-75 mEq/day

Vegan (or near vegan) diet: -43.5 - -39.0 mEq/day

# Treat Acidosis with Fruits & Veggies!

CKD stage 4 patients randomized to receive bicarbonate or fruits & veggies
- Fruits & vegetables group were given free produce
- Prescribed by RD to lower PRAL by ½
  - *Enough produce for all people in household!*

After 1 year, fruit & vegetable group:
- Lower body weight (78 vs 84kg)
- Lower Systolic blood pressure (131.7 vs. 136.0 mmHg)
- Lower PRAL (39.6 vs. 59.3 mEq/day)
- Lower CO2 in both groups
- NO difference in plasma potassium or GFR



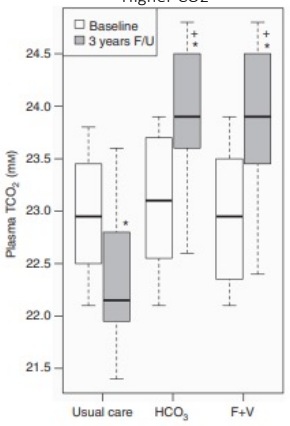

Goraya N, Simoni J, Jo C-H, Wesson DE. A Comparison of Treating Metabolic Acidosis in CKD Stage 4 Hypertensive Kidney Disease with Fruits and Vegetables or Sodium Bicarbonate. *CJASN*. 2013;8(3):371-381. doi:10.2215/CJN.02430312

# Treat Acidosis EARLY with Fruits & Veggies!

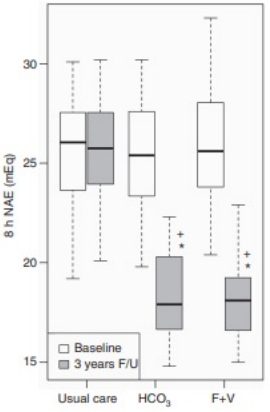
108 CKD stage 3 patients randomized to usual care, fruits & veggies OR bicarbonate (not necessarily $CO_2$<22)

After 3 years…

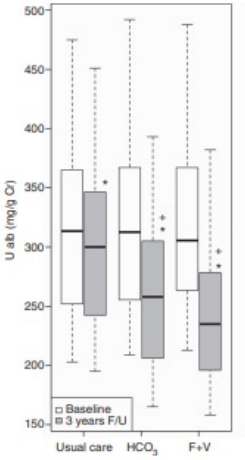
Higher CO2



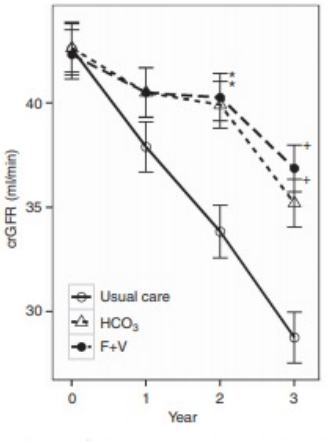

Lower Net Acid Excretion




Lower Urine Albumin:Creatinine




Preserved kidney function!




Goraya N, Simoni J, Jo C-H, Wesson DE. Treatment of metabolic acidosis in patients with stage 3 chronic kidney disease with fruits and vegetables or oral bicarbonate reduces urine angiotensinogen and preserves glomerular filtration rate. *Kidney Int*. 2014;86(5):1031-1038. doi:10.1038/ki.2014.83

# Improved Gut Health

# Microbiome & CKD

CKD causes systemic inflammation ↔ Inflammation exacerbates CKD

Changes in gut microbiome identified as a significant source of inflammation in CKD

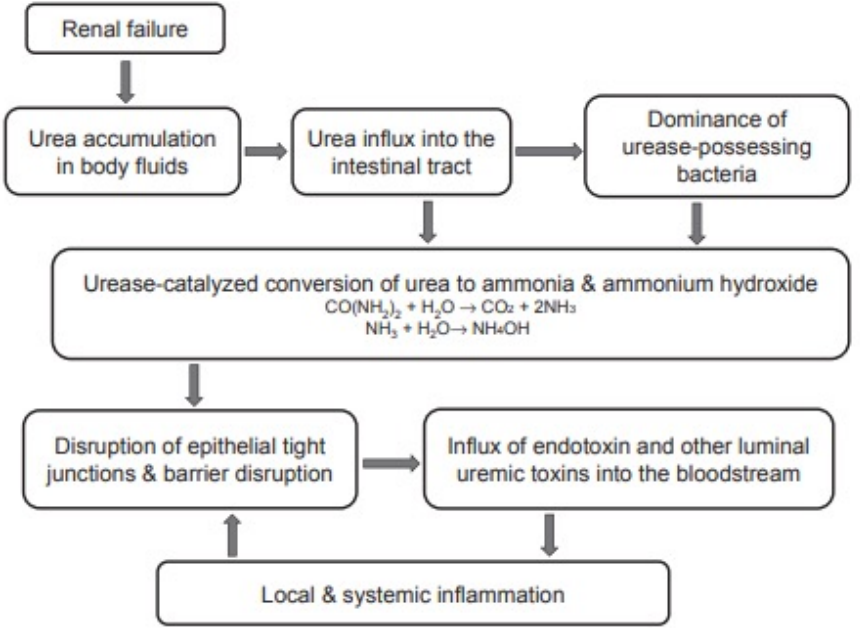
Inflammatory markers increase as CKD progresses

Need more research

- Do probiotics, prebiotics or diet changes result in changes to gut microbiota?
- Does a change in gut microbiota result in reduced inflammation and CKD progression?

Generally, high fiber/fruits & vegetable diets associated with improvements in microbiome

Lau WL, Vaziri ND. The Leaky Gut and Altered Microbiome in Chronic Kidney Disease. *Journal of Renal Nutrition*. 2017;27(6):458-461.




Lau WL, Vaziri ND. The Leaky Gut and Altered Microbiome in Chronic Kidney Disease. *Journal of Renal Nutrition*. 2017;27(6):458-461.

# Microbiome & CKD – Increased risk CVD

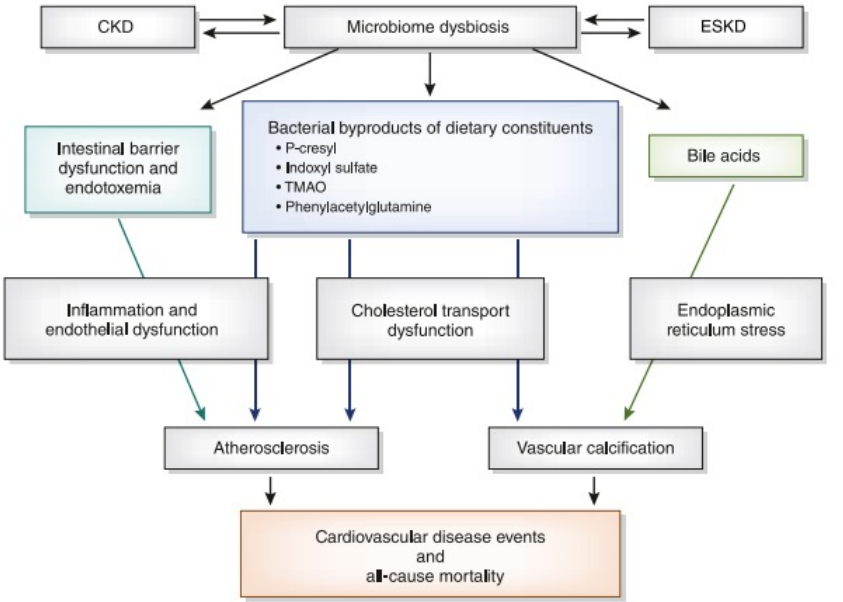



**Figure 1. | Mechanisms by which microbiome dysbiosis in kidney disease may lead to cardiovascular disease.** TMAO, trimethylamine-*N*-oxide.

Jovanovich A, Isakova T, Stubbs J. Microbiome and Cardiovascular Disease in CKD. *CJASN*. 2018;13(10):1598-1604.

# Reduced Absorption of Phosphorus

# 2020 KDOQI/AND Guidelines

**Dietary Phosphorus Source: CKD 1-5D & Post-Transplant**

"Consider the bioavailability of phosphorus sources" (OPINION)

**CKD 3-5 & Hemodialysis**

"Adjust dietary phosphorus to maintain serum phosphate levels in the normal range" (1B)

No absolute amount of phosphorus recommended.

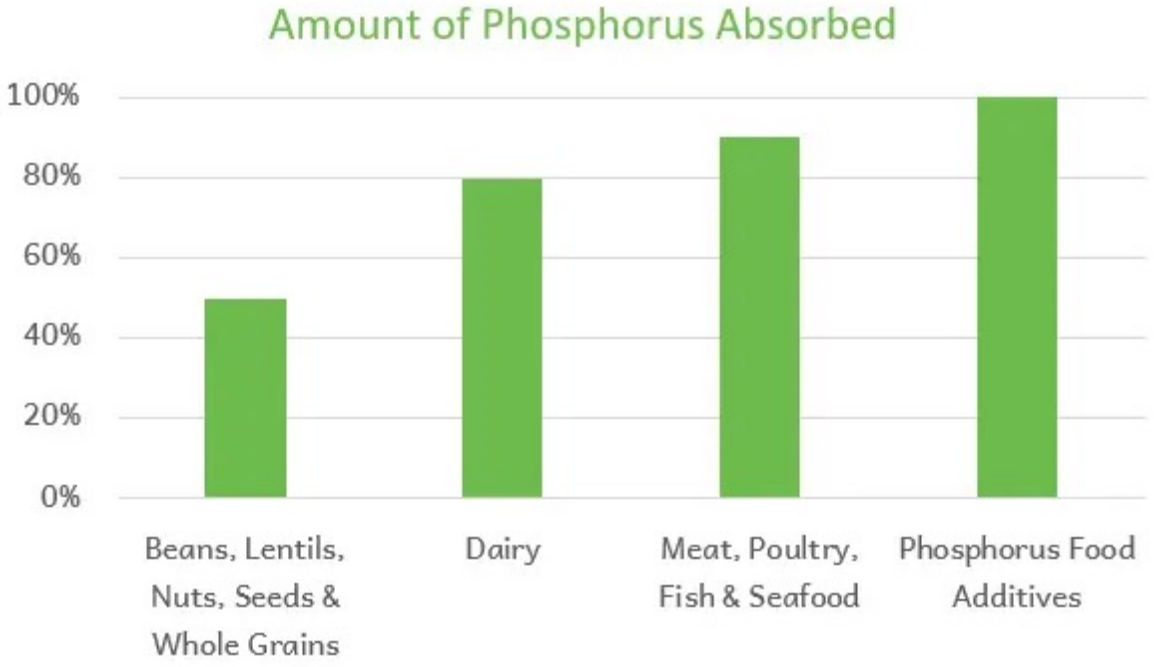
Ikizler A, Burrowes J, Byham-Gray L, et al. KDOQI Clinical Practice Guideline for Nutrition in CKD: 2020 Update. *Am J Kidney Dis*. 2020;76(3):S1-S107.

# 4oz, cooked chicken breast

Calories: 182
Protein: 34g
Potassium: 408mg
Phosphorus: 260mg

# ½ cup black beans

Calories: 57
Protein: 8g
Potassium: 306mg
Phosphorus: 121mg




Noori N, Sims JJ, Kopple JD, et al. Organic and inorganic dietary phosphorus and its management in chronic kidney disease. *Iran J Kidney Dis*. 2010;4(2):89-100.
Itkonen ST, Karp HJ, Lamberg-Allardt CJE. Bioavailability of phosphorus. *Dietary Phosphorus: Health, Nutrition, and Regulatory Aspects*. Published online January 1, 2017:221-233. doi:10.1201/9781315119533

# 4oz cooked chicken breast

Calories: 182
Protein: 34g
Potassium: 408mg
Phosphorus: ~~260mg~~ 234mg

# ½ cup black beans

Calories: 57
Protein: 8g
Potassium: 306mg
Phosphorus: ~~121mg~~ 61mg

# Phosphorus Food Additives

Contribute 300-1000mg phosphorus per day

Can increase phosphate content of food up to 70%

Are becoming more common in food supply
37% of foods consumed

Common in many OTC and prescribed medications in CKD
Norvasc, Amiloride, Januvia, Epogen, Tums, Crestor, Zoloft

Often not reflected in dietary analysis nutrient databases


**Ingredients:** Enriched Corn Meal (Corn Meal, Ferrous Sulfate, Niacin, Thiamin Mononitrate, Riboflavin, and Folic Acid), Vegetable Oil (Contains One or More of the Following: Corn, Soybean, or Sunflower Oil), Whey, Salt, Cheddar Cheese (Cultured Milk, Salt, Enzymes), Partially Hydrogenated Soybean Oil, Maltodextrin, Disodium Phosphate, Sour Cream (Cultured [illegible] Artificial Flavor, Monosodium Glutamate, Lactic Acid, Artificial Colors (Including Yellow 6), and Citric Acid. **CONTAINS MILK INGREDIENTS.**

## Nutrition Facts

Serving Size 1 oz.

| Amount Per Serving | |
|---|---|
| **Calories** 160 | Calories from Fat 90 |
| | **% Daily Value*** |
| **Total Fat** 10g | **15%** |
| Saturated Fat 1.5g | **8%** |
| Trans Fat 0g | |
| **Cholesterol** 0mg | **0%** |
| **Sodium** 370mg | **16%** |
| **Total Carbohydrate** 15g | **5%** |
| Dietary Fiber less than 1g | **1%** |
| Sugars less than 1g | |
| **Protein** 2g | |

| | | |
|---|---|---|
| Vitamin A 0% | • | Vitamin C 0% |
| Calcium 0% | • | Iron 4% |
| Vitamin E 6% | • | Thiamin 6% |
| Riboflavin 4% | • | Niacin 4% |
| Phosphorus 4% | | |

* Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:

| | Calories: | 2,000 | 2,500 |
|---|---|---|---|
| Total Fat | Less than | 65g | 80g |
| Sat Fat | Less than | 20g | 25g |
| Cholesterol | Less than | 300mg | 300mg |
| Sodium | Less than | 2,400mg | 2,400mg |
| Total Carbohydrate | | 300g | 375g |
| Dietary Fiber | | 25g | 30g |

Calories per gram:
Fat 9 • Carbohydrate 4 • Protein 4

Calvo MS, Uribarri J. Contributions to Total Phosphorus Intake: All Sources Considered. *Seminars in Dialysis*. 2013;26(1):54-61.
Benini O, D'Alessandro C, Gianfaldoni D, Cupisti A. Extra-Phosphate Load From Food Additives in Commonly Eaten Foods: A Real and Insidious Danger for Renal Patients. *Journal of Renal Nutrition*. 2011;21(4):303-308.
Picard K. Potassium Additives and Bioavailability: Are We Missing Something in Hyperkalemia Management? *Journal of Renal Nutrition*. 2019;29(4):350-353.

# Common Sources Phosphorus Food Additives

Snack Foods

Processed cheese or dairy (non-dairy creamer)

Frozen prepared foods

Beverages (more than just cola!)

Cereals

Sauces & dressings

Shelf stable prepared foods (canned meals, convenience foods)

Non-dairy creamer

RESTAURANTS & FAST FOOD

# Possible Better Potassium Control?

# Potassium

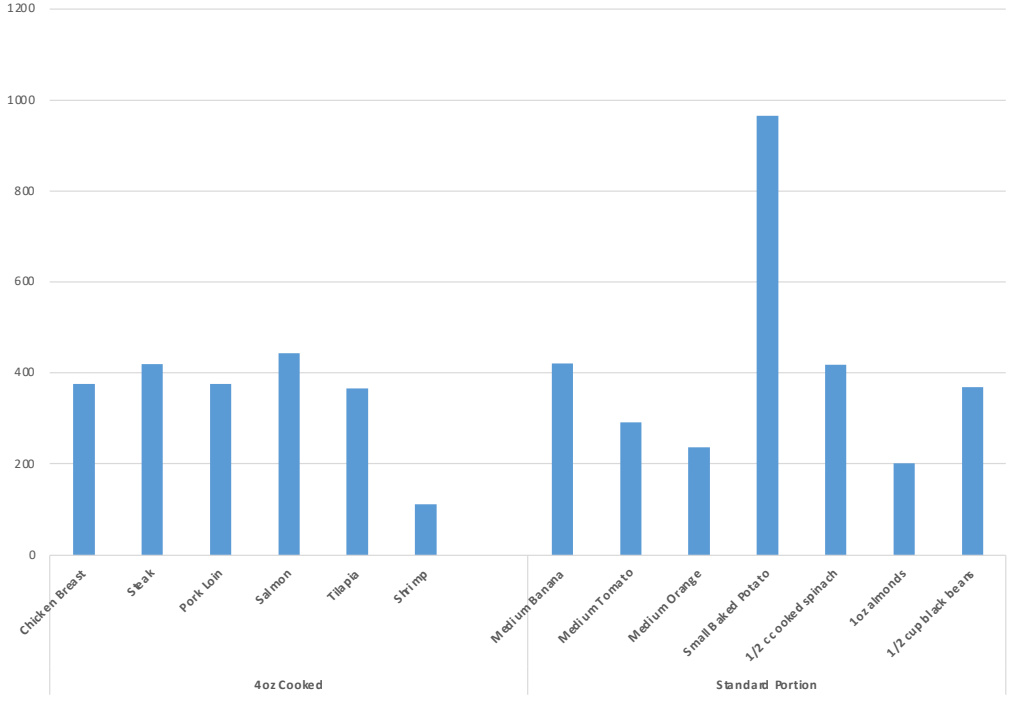
Hyperkalemia in kidney disease
- Accounts for 25% of emergent dialysis treatments
- Leads to abdominal cramping, weakness, paresthesia, cardiac arrhythmias and cardiac arrest

Little to no research to support a low potassium diet for CKD or ESRD

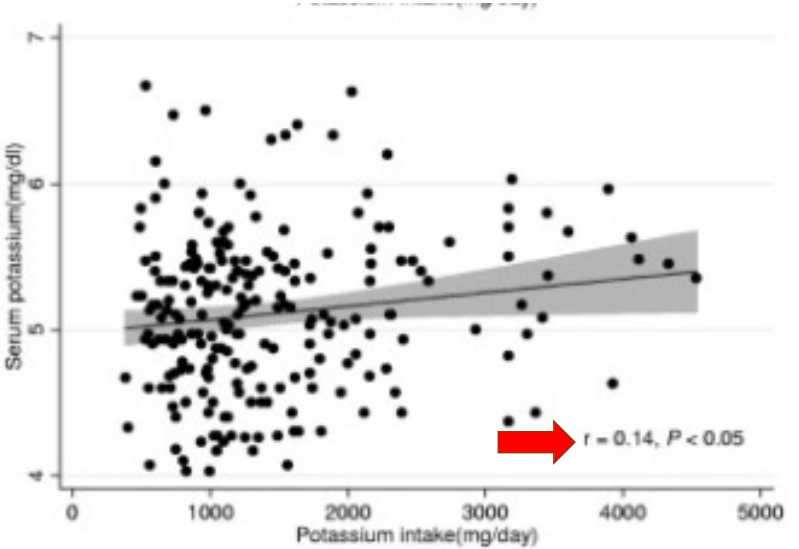
Other factors that can impact potassium
- Medications
- Residual kidney function
- Hydration status
- **Acid-base status**
- **Glycemic control**
- Adrenal function
- Catabolism
- GI (vomiting, diarrhea, **constipation,** bleeding)

St-Jules D, Goldfarb D, Sevick M. Nutrient non-equivalence: Does restricting high-potassium plant foods help to prevent hyperkalemia in hemodialysis patients? *J Ren Nutr*. 2016;26(5):282-287. doi:10.1053/j.jrn.2016.02.005

# Potassium Content of Foods

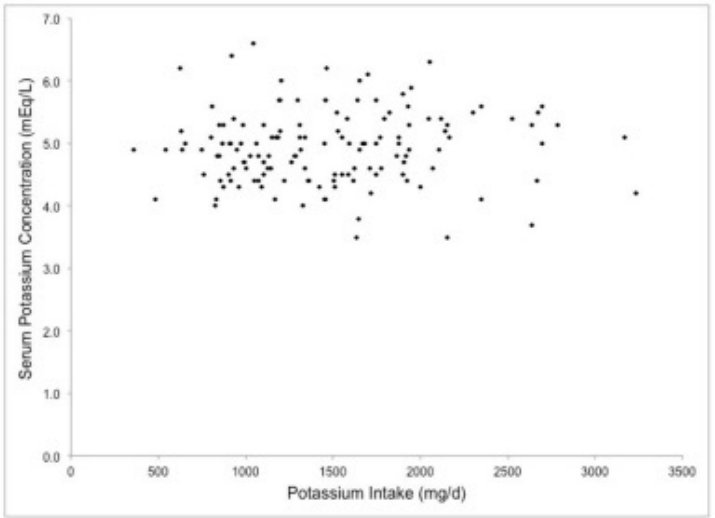


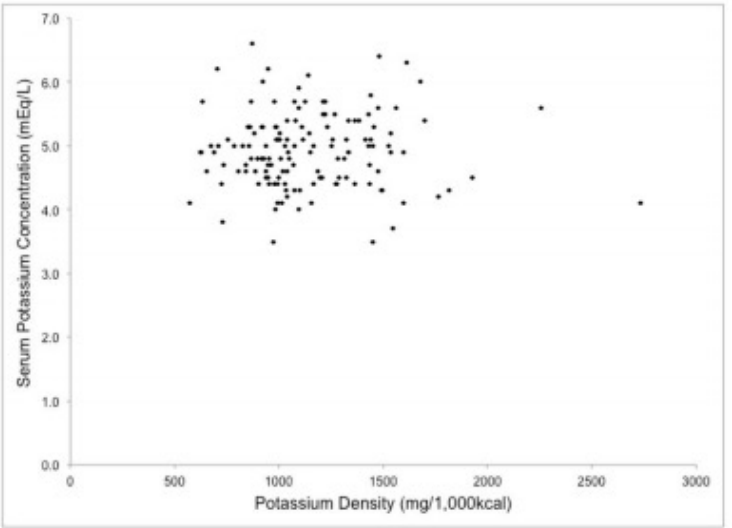
# Potassium Intake ≠ Serum Potassium




Noori N, Kalantar-Zadeh K, Kovesdy CP, et al. Dietary Potassium Intake and Mortality in Long-term Hemodialysis Patients. *American Journal of Kidney Diseases*. 2010;56(2):338-347. doi:10.1053/j.ajkd.2010.03.022

# Potassium Intake & Potassium Diet Density ≠ Serum Potassium




St-Jules D, Goldfarb D, Sevick M. Nutrient non-equivalence: Does restricting high-potassium plant foods help to prevent hyperkalemia in hemodialysis patients? *J Ren Nutr*. 2016;26(5):282-287. doi:10.1053/j.jrn.2016.02.005

# Potassium & Acid-Base Balance

In acidic environments, more potassium shifts to extracellular compartments (↑ serum potassium)

Higher bicarbonate dialysate results in faster lowering of serum potassium, despite removing less potassium

Remember:

- Meat has a HUGE acid load (PRAL)
- Adding fruits and veggies reduced acidosis

St-Jules D, Goldfarb D, Sevick M. Nutrient non-equivalence: Does restricting high-potassium plant foods help to prevent hyperkalemia in hemodialysis patients? *J Ren Nutr*. 2016;26(5):282-287. doi:10.1053/j.jrn.2016.02.005
Heguilén RM, Sciurano C, Bellusci AD, et al. The faster potassium-lowering effect of high dialysate bicarbonate concentrations in chronic haemodialysis patients. *Nephrol Dial Transplant*. 2005;20(3):591-597. doi:10.1093/ndt/gfh661

# Potassium & Insulin Resistance

Insulin helps shift potassium into cells

- Lower peak in serum potassium if glucose is provided with meal[2,3]
- In fasted state, see higher peak in serum potassium with potassium challenge[3]

High prevalence of insulin resistance in CKD (diabetes 2nd cause of CKD)

Plant based diets associated with improved insulin sensitivity

1. St-Jules D, Goldfarb D, Sevick M. Nutrient non-equivalence: Does restricting high-potassium plant foods help to prevent hyperkalemia in hemodialysis patients? *J Ren Nutr*. 2016;26(5):282-287. doi:10.1053/j.jrn.2016.02.005
2. Hc G, Cr K, Me R, Mh M. Functional impairment in chronic renal disease. 3. Studies of potassium excretion. *Am J Med Sci*. 1971;261(5):281-290. doi:10.1097/00000441-197105000-00007
3. Allon M, Dansby L, Shanklin N. Glucose modulation of the disposal of an acute potassium load in patients with end-stage renal disease. *Am J Med*. 1993;94(5):475-482. doi:10.1016/0002-9343(93)90081-Y

# Excretion of Potassium in Stool

Eventually, potassium must be removed from body

- 90% of potassium removed by kidneys in healthy people[1]

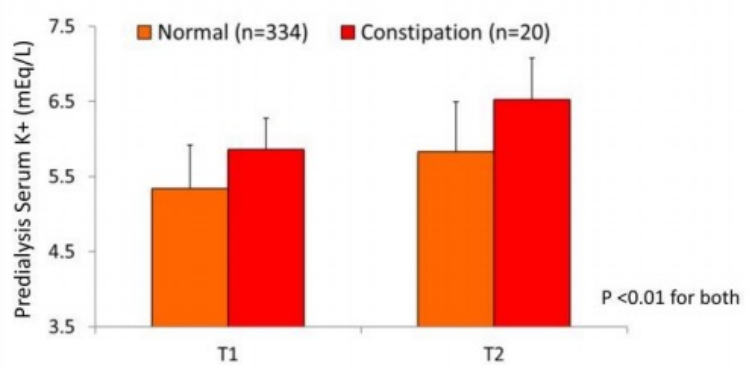
3x higher stool potassium excretion in dialysis (37% vs. 12%)[2]

- Stool potassium excretion directly related to potassium intake[2]

About half of HD patients report constipation[3]

Up to 19% in CKD (need more studies)[4]

Constipation associated with higher serum potassium in HD patients[5]




1. St-Jules D, Goldfarb D, Sevick M. Nutrient non-equivalence: Does restricting high-potassium plant foods help to prevent hyperkalemia in hemodialysis patients? *J Ren Nutr*. 2016;26(5):282-287.
2. Hayes CP, McLeod ME, Robinson RR. An extravenal mechanism for the maintenance of potassium balance in severe chronic renal failure. *Trans Assoc Am Physicians*. 1967;80:207-216.
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# Potassium Food Additives

Prevalence in food supply is growing
- 9% of foods consumed in dialysis patients
- Known to be high in meats – especially processed meats
  - *2-3X higher potassium in enhanced meats*

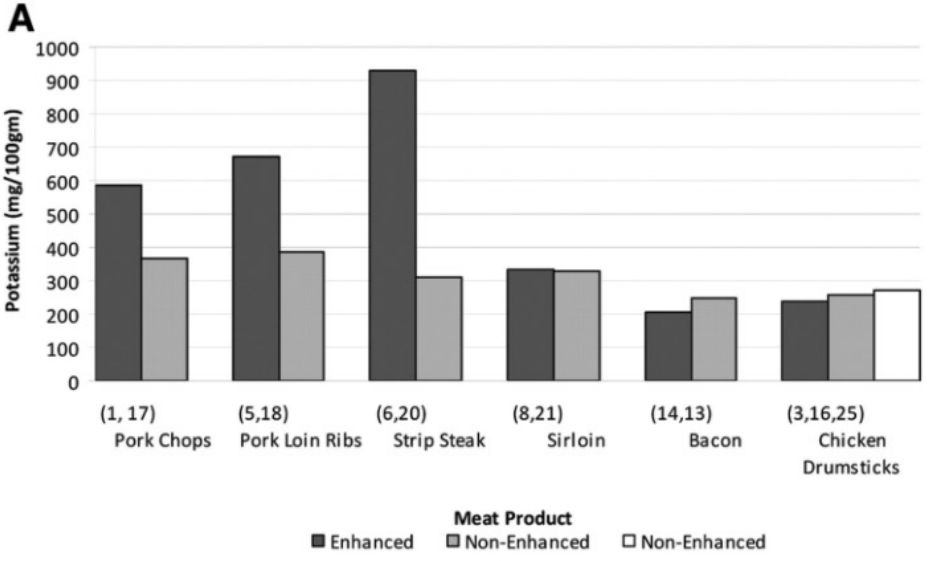
Often used in “low sodium” products
- 44% more potassium

Likely more bioavailable than naturally occurring potassium (~90-100% vs. 50-60%)


Crystal Light Lemonade

Picard K. Potassium Additives and Bioavailability: Are We Missing Something in Hyperkalemia Management? *Journal of Renal Nutrition*. 2019;29(4):350-353.

# Potassium Food Additives




Sherman RA, Mehta O. Phosphorus and potassium content of enhanced meat and poultry products: implications for patients who receive dialysis. *Clin J Am Soc Nephrol*. 2009;4(8):1370-1373. doi:10.2215/CJN.02830409

# Reduced Mortality in Dialysis?

# Plant Based Diets & Dialysis

Reduced risk of death in peritoneal dialysis patients

10% increase in plant based:total protein =

*71% (95% CI, 90-14%) in all cause mortality*

*89% (95% CI, 98-29%) reduction CVD mortality*

Liu X. The associations of plant-based protein intake with all-cause and cardiovascular mortality in patients on peritoneal dialysis. Nutr. Metab. Cardiovasc. Dis. 2020;30:967-976.

# How is fruit and vegetable intake related to mortality in hemodialysis patients?

CJASN
Clinical Journal of American Society of Nephrology

## Methods and Cohort

GA²LEN
Global Allergy and Asthma European Network
Network of Excellence

Food frequency questionnaire

Europe and South America HD patients

N = 8078

**Median follow-up 2.7 years**

## Findings

**4%**

consumed recommended ≥4 servings daily

**Servings**

**8**
per week

**4-14**
interquartile range

**Deaths**

**2082**
all-cause

**954**
cardiovascular

### Adjusted HR of all-cause mortality by servings

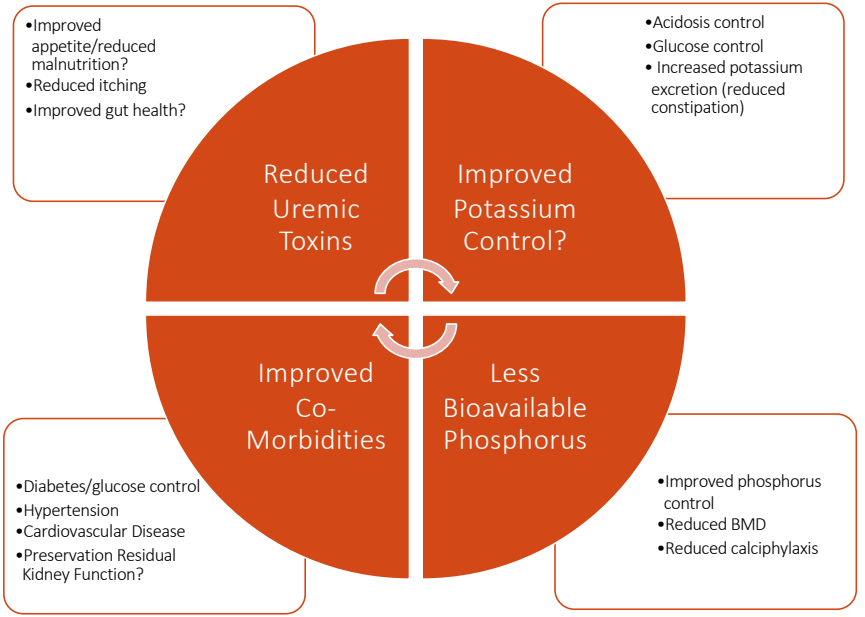
| REFERENCE | 0.90 (95% CI 0.81-1.00) | 0.80 (95% CI 0.71-0.91) |
|---|---|---|
| LOWEST TERTILE (0-5.5, median 2) | MIDDLE TERTILE (5.6-10, median 8) | HIGHEST TERTILE (>10, median 17) |

**Conclusions** Fruit and vegetable intake in the hemodialysis population is low and a higher consumption is associated with lower all-cause and non-cardiovascular death.

Valeria Saglimbene, Germaine Wong, Marinella Ruospo, Suetonia Palmer, et al. ***Fruit And Vegetable Intake and Mortality In Adults Undergoing Maintenance Hemodialysis.*** CJASN doi: 10.2215/CJN.08580718.
**Visual Abstract by Michelle Lim, MBChB**

Saglimbene VM. Fruit and Vegetable Intake and Mortality in Adults Undergoing Maintenance Hemodialysis. CJASN 2019;14(2):250-260.

# Possible Benefits of Plant Based Diet in Dialysis



# Summary

**Perhaps more absolute potassium & phosphorus, BUT:**

- Higher in protein & lower in alkali
  - Faster CKD progression
- More bioavailable phosphorus
- More difficult to control potassium?
  - Likely potassium additives
  - Lacking benefits for:
    - Constipation (control?)
    - Glucose Control
    - Acidosis
- No benefits for blood pressure
- Impact on gut microbiota?
- More Restrictive
  - Reduced food satisfaction and adherence?

# Need More Research!

Large scale intervention trials

- Get more professionals on board & further update guidelines

Understand actual impact of diet on potassium & phosphorus control

Adequate protein intake/malnutrition? Especially for dialysis populations

MUCH more to understand effects of diet and/or probiotics on CKD outcomes

Is this do-able for patients?

# Questions?

Thank you!

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